Endotracheal intubation in the field: pro position

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Airway, breathing and circulation will continue to be the top priorities of emergency medical care for the foreseeable future. Correction of hypoxia by bag-valve mask ventilation in the prehospital environment is problematic. It is difficult to obtain a mask seal, challenging to assist patients who have increased work of breathing or a clenched jaw, and essentially impossible to use end-tidal carbon dioxide (CO_2) as a gauge of ventilation. Bag-valve mask ventilation does not facilitate tracheal suctioning or protect the airway, and it increases the risk of regurgitation by causing gastric insufflation.

Endotracheal intubation allows for effective sustained ventilation by one caregiver, measurement of end-tidal CO_2 as a gauge of ventilation, and suctioning of tracheal debris. It has been used in operating theatres and emergency departments for years as the gold standard of airway management, yet it is in the challenging prehospital environment with the patient on the ground or at knee level, the ambulance bouncing around, the space limited, and the hands few that the advantages of endotracheal intubation can truly be realized.

The Eastern Association for the Surgery of Trauma published evidence-based guidelines for emergency endotracheal intubation (Dunham et al, 2003). Despite there being no randomized, controlled clinical trials, they endorse endotracheal intubation with a level 1 recommendation in cases of trauma patients with airway obstruction, hypoventilation, severe hypoxaemia (hypoxaemia despite supplemental oxygen), severe cognitive impairment (Glasgow Coma Scale (GCS) score ≤ 8), cardiac arrest, and severe haemorrhagic shock. Some studies have associated endotracheal intubation with increased morbidity and mortality, particularly in trauma patients (Bochicchio et al, 2003; Davis et al, 2003; Gausche et al, 2004). This article presents three explanations, based on current research, for exercising restraint before discarding field endotracheal intubation as a requisite skill in the prehospital environment.

INTUBATION IS A TOOL

Most studies to date have examined endotracheal intubation as a treatment when, in fact, it is a tool that is used to apply a treatment. An endotracheal tube provides oxygen and ventilation while allowing suctioning and preventing the aspiration of secretions, blood and vomitus. An endotracheal tube is not, however, a treatment itself. Herein lies the difficulty in assessing the efficacy of endotracheal intubation in the prehospital environment. Clinical studies have demonstrated that cerebral hypoxia and hypotension are the most critical, and correctable, conditions that are independent predictors of outcome (Chesnut et al, 1993). Dunham and colleagues (2004) have found that cerebral hypoxia is common, and is associated with worse outcomes in patients with severe traumatic brain injury (TBI). At the same time, Muizelaar and colleagues (1991) have shown that more is not always better, in that too much ventilation and CO_2 washout can increase cerebral deficit following TBI.

Hyperventilation has also been found to be detrimental in cardiac arrest patients, probably as a result of decreases in preload, cardiac output, coronary perfusion, and cerebral perfusion (Pitts and Kellerman, 2004). There is significant evidence to suggest that both too little and too much ventilation can adversely affect outcome. Most studies of endotracheal intubation have looked at whether or not a tube was placed, and not at whether the tube was effectively utilized to administer treatment. These studies then attempt to associate a causal effect of intubation on poor outcome.

Future studies must look at the treatment administered, including incidences of hypoxia and hyperventilation, in order to answer the research question accurately, and not presume that the procedure of placing an endotracheal tube is the cause of the poor outcome.

INTUBATION IS A MARKER OF SICKER PATIENTS

One must consider that a patient requiring endotracheal intubation in the field is physiologically sicker than one that does not. A patient with a

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GCS score of ≤ 8, flaccid jaws, and poor oxygen saturation is sicker than a patient with a GCS score ≤8, clenched jaws and good oxygen saturation, even with matching head abbreviated injury scores (AIS). Wang et al (2004) attempted to demonstrate a negative effect of intubation in TBI patients by comparing patients intubated in the field with those intubated after hospital arrival. The patients were 'matched' through a multivariate analysis process that did not consider their GCS, oxygen saturations, respiratory rates or blood pressures at the time of the decision to intubate. In a similar fashion, Davis et al (2003) associated prehospital rapid sequence intubation (RSI) with increased mortality in TBI patients when compared with historical controls with matching head AIS, without consideration of the patients' physiology in the field.

Bochicchio et al (2003) found increased mortality and higher incidence of pneumonia and respiratory failure-related complications in patients receiving field RSI. This should not have been a surprising finding, however, as the prehospital protocols specifically reserved RSI for patients with evidence of respiratory failure, leaving the less sick patients to be intubated in the hospital. Field intubation is generally a marker of sicker patients. This premise is further supported by the work of Frankel et al (1997) who found that survival for patients intubated in the prehospital setting was 11% *vs* 40% for those intubated in hospital, while expected survival by trauma score and injury severity score analysis was 2% and 45% respectively.

INTUBATION TRAINING DEFINES SUCCESS

An important lesson can be learned from the many studies looking at outcomes of patients that have undergone endotracheal intubation in the field. Training does matter. Studies by Katz and Falk (2001), Gausche et al (2004), and Davis et al (2003) utilized very limited initial training and no recurrent training. Katz and Falk demonstrated that there can be alarming rates of misplaced endotracheal tubes in emergency medical services (EMS) systems that do not have strong medical supervision. Gausche et al showed that endotracheal intubation rates can be quite low when inadequate paramedic training is provided. Davis et al (2003) demonstrated that inadequate training in appropriate monitoring techniques can result in significant overventilation in certain EMS systems using prehospital RSI.

The skill of intubation, particularly when coupled with the use of neuromuscular blockade in RSI, is one that requires constant refreshing. Practice begets success. The majority of the recently published studies looking at prehospital intubation have had very low procedure volumes per individual caregiver. For example, Katz's study had 108 intubations among 650 paramedics while Gausche's study had 416 intubations among 2584 paramedics. This equates to one intubation for every six paramedics over the course of the entire study. No individual can be expected to maintain such a critical skill with such limited opportunity to practise it.

CONCLUSIONS

Intubation is a tool to administer a treatment and should be studied as such. In studies of effectiveness, intubation has most often served as a marker for the patients that are most sick. Endotracheal intubation requires significant training, adequate call volume, continued retraining, and a strong quality assurance program with an actively involved medical director. These form the foundation on which successful prehospital airway management is built. HM

Conflict of interest: none

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KEY POINTS

- Endotracheal intubation is a tool and not a treatment.
- Evaluation of prehospital intubation must include whether it was used effectively to deliver the intended treatment.
- Endotracheal intubation offers many advantages over bag-valve mask ventilation for correcting hypoxia in the prehospital environment.
- Field endotracheal intubation is a marker of sicker patients; future studies need to consider patient oxygenation, ventilation, blood pressure and levels of consciousness at the time of airway management.
- Effective prehospital endotracheal intubation programmes require significant initial and recurrent training with strong medical supervision.

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